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CONTROLLABILITY CONDITIONS FOR SWITCHED LINEAR SINGULAR SYSTEMS

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Abstract. The controllability problem of switched linear singular (SLS) systems is investigated in this paper. Under the regularity condition of all switching subsystems, a necessary condition and a sufficient condition for complete controllability are presented, and the conditions for complete reachability of the SLS system given in Meng and Zhang [14] are weakened. It is proved that for the SLS system under certain conditions complete controllability and complete reachability are equivalent.

Keywords. Switched system, singular system, controllability, reachability, admissible control.

AMS (MOS) subject classification: 93B05

1 Introduction

During the past few years, the study of switched systems has been revivified (see e.g. Bengea and DeCarlo [1], Cheng *et al* [4], De Santis *et al* [6], Escobar *et al* [8], Liberzon and Morse [11], Stanford and Conner [16], Vidal *et al* [22]). Various conditions and subtle results on controllability, reachability and observability etc. are presented in Ezzine and Haddad [7], Ge *et al* [10], Sun *et al* [18], Sun and Zheng [19], and Xie and Wang [24,25], respectively, for continuous-time periodic, general (non-periodic) switched control systems, and discrete-time switched control systems.

Switched linear singular (SLS) systems constitute an important class of switched systems, which arises, for example, in electrical networks and economic systems (see e.g. Bedrosian and Vlach [2], Cantó *et al* [3], Gandolfo [9], Opal and Vlach [15], Silva and de Lima [17], Tanaka [20], Tolsa and Salichs [21], Vlach *et al* [23], and the references therein). Due to the existence of switching actions, state-inconsistence phenomena often occurs. This may result in the discontinuity of network variables and in the presence of impulse voltage and currents at the switching instants. Physically, some problems like sparks and short circuits etc. may occur (Escobar *et al* [8]). For dynamic